Vanderhoof
Forest District

Vegetation Resources Inventory
Strategic Inventory Plan

PREPARED FOR:

MINISTRY OF FORESTS
RESOURCES INVENTORY BRANCH

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EXECUTIVE SUMMARY

This Vegetation Resources Inventory (VRI) Strategic Inventory Plan outlines VRI activities and products that address forest management and inventory issues in the Vanderhoof Forest District (VFD) identified at the February 22, 2000 stakeholders meeting. The stakeholders are mainly partners of the VFD Innovative Forest Practices Agreement (IFPA) and include the Ministry of Forests, Ministry of Environment Lands and Parks, Canadian Forest Products Ltd., Fraser Lake Sawmills Ltd., L&M Lumber Ltd., Lakeland Mills Ltd., Plateau Forest Products Ltd, Slocan Group, and the Small Business Forest Enterprise Program.

The stakeholders identified the following VRI activities and products:

1. Incorporate ecological and timber attributes into the District Phase I database using retrofitted photo-interpretation and data from other sources. This will support provincial and timber-emphasis inventories, habitat mapping, ecosystem mapping, riparian mapping, and other applications over the district.
2. Conduct timber emphasis ground sampling in the Vegetated Treed area of the District to provide statistically valid timber volumes and polygon-specific tree attributes, to support the timber supply review in the Prince George Timber Supply Area. The ground sampling will include Net Volume Adjustment Factor sampling to check loss factors and to develop new taper equations for Pl (for valuation cruising).
3. Conduct timber emphasis ground sampling in the deciduous stands in the VFD to improve species composition descriptions for these stands.
4. Conduct provincial VRI ground sampling throughout the VFD to provide baseline spatial and non-spatial data for timber and non-timber resources to support provincial Criteria and Indicators and inventory reporting, monitoring, and research (e.g. verify plant associations at risk).
5. Integrate the coarse woody debris (CWD) inventory data collected by Madrone Consultants Ltd. into the VRI database. (This objective was not discussed in detail at the stakeholder meeting).

These VRI activities and products will support the IFPA objectives and other resource specific interpretations. They may be implemented in smaller units (e.g., Landscape Units) across the District. They may also be jointly implemented to address common District issues within the Prince George TSA.

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1. INTRODUCTION

1.1 Background

This Vegetation Resources Inventory (VRI) Strategic Inventory Plan (VSIP) outlines VRI activities and products needed to address forest management and inventory issues in the Vanderhoof Forest District (VFD) identified by stakeholders at the February 22, 2000 meeting. The VSIP provides detail for photo interpretation, timber emphasis sampling, and Provincial ground sampling in the VFD.

The Ministry of Forests (MOF) Resources Inventory Branch (RIB) prepared this report in consultation with the VFD stakeholders. These stakeholders are mainly partners in the VFD Innovative Forest Practices Agreement (IFPA) initiative. They include the Ministry of Forests (MOF), Ministry of Environment Lands and Parks (MELP), Canadian Forest products Ltd., Fraser Lake Sawmills Ltd., L&M Lumber Ltd., Lakeland Mills Ltd., Plateau Forest products Ltd., Slocan Group, and the Small Business Forest Enterprise Program. A preliminary VSIP was reviewed and verbally approved by the District stakeholders during a March 23 conference call. Comments from the conference call were incorporated into this final VSIP. [1]

1.2 Vegetation Resources Inventory

The VRI is a process approved by the Resources Inventory Committee (RIC) to assess the quantity and quality of BC's timber inventory and vegetation resources. It consists of:

1. *Photo-Interpretation (Phase I)*
   - Delineating and classifying vegetation polygons using the BC Landcover Classification Scheme (BCLCS).
   - Making initial polygon vegetation attribute estimates.

[1] Some of the information in this VSIP was presented earlier in a discussion paper prepared by the RIB entitled *Vanderhoof Forest District Vegetation Resources Inventory Forest Management and Inventory Issues Discussion Paper* (February 14, 2000).

2. *Ground Sampling (Phase II)*
   - Locating and establishing sample plots.
   - Collecting tree, site, soil, plant, and succession data as well as coarse woody debris and range data.
   - Net Volume Adjustment Factor (NVAF) sampling.
   - Within Polygon Variation (WPV) sampling.

These VRI procedures and other terms are defined in Appendix I.

When implemented, the VRI will provide spatial and non-spatial products for resource-specific management interpretations (including timber, ecosystem, and habitat management), provincial inventory reporting, monitoring, and research. Spatial products include:

- Line work – polygon boundaries.
- Vegetation Inventory File Database – adjusted and unadjusted polygon labels and estimates.

Non-spatial products include:

- Raw Database – Raw data from field cards.
- Summary Database – Compiled data and inventory statistics.
- NVAF Database – NVAF stem analysis data (raw, compiled, and statistics).
- WPV Database – WPV polygon data (raw, compiled, and statistics).

1.3 VRI Overriding Principles

VRI procedures are being implemented throughout the province. Implementation is guided by the following principles:

- Integrate provincial inventory activities including provincial VRI, management inventories, and the National Forest Inventory.
- Implement inventory projects to satisfy business needs as defined in the VSIP and VRI Project Implementation Plan (VPIP) documents. The VPIP identifies priorities and spatial location of VRI activities.
- Develop spatial VRI products using a structured methodology (e.g., implement photo interpretation activities by groups such as mapsheets or watersheds and estimate all attributes listed in the photo interpretation manual).

- Implement inventory projects following approved VRI implementation standards as defined in the RIB 1998 report *Vegetation Resources Inventory Implementation Strategy to Integrate Management, Provincial, and National Inventories.*

VRI standards will be used when implementing inventories to address issues identified by the Forest Resources Commission's 1991 report *The Future of Our Forests*. These issues include inadequate provincial forest inventories, a lack of precision statements for these inventories, inadequate non-timber information, and a narrow focus on commercial timber volume and the operable landbase.

1.4 VRI Planning

Planning is an important component of the VRI process and related activities (Figure 1). The VRI planning process develops VSIPs and VPIPs for defined areas such as a forest district. Procedures for preparing the VSIPs and VPIPs are available from Keith Tudor (MOF).

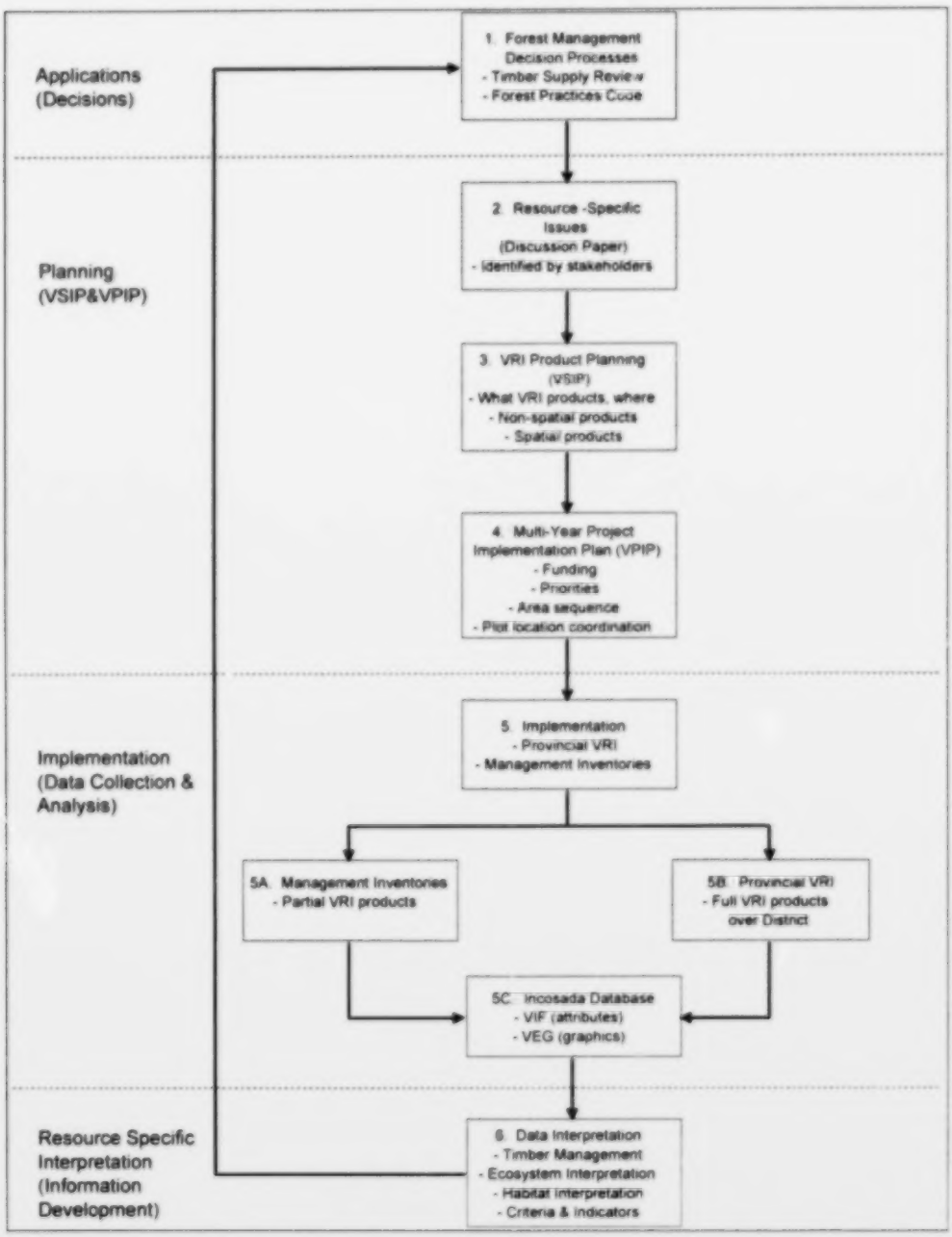

Figure 1. The Vegetation Resources Inventory process.

2. BUSINESS CONSIDERATIONS

2.1 Landbase

The VFD covers 1.38 million ha, approximately 18% of the Prince George (PG) Timber Supply Area (TSA) (Table 1). The main species on the forested landbase are lodgepole pine (Pl) and spruce (Sx). There are minor components of Aspen, Balsam, and Douglas fir (Table 2).

Table 1. VFD forested (stocked & productive) by species.

Land Classification	Area (ha)	%
Forested	1,197,480	86.4
Immature	*419,222*	*35.0*
Mature	*696,273*	*58.2*
Not Stocked	*55,162*	*4.6*
Non-Productive	*26,823*	*2.2*
Non-Forest	187,712	13.6
No Typing Available	1	0.0
Total	***1,385,193***	***100.0***

Table 2. VFD landbase by forest cover.

Leading Species	Area (ha)	%
Lodgepole pine	843,358	75.6
Spruce	150,762	13.5
Deciduous	86,566	7.8
Balsam	27,308	2.4
Douglas-fir	7,477	0.7
Larch	24	0.0
Total	***1,115,495***	***100.0***

2.2 Forest Management Considerations

Significant forest management issues in the PG TSA (and pertinent to the VFD) were highlighted in the recent timber supply review data package. Use of the VRI to address these issues is identified in Table 3, but the relative importance of the VRI is not indicated. For example, the package does not show that a statistically accurate timber volume estimate may be more relevant than all other issues combined.

Other forest management considerations include:

- Provincial reporting of the Criteria and Indicators (C&I) of sustainable forest management as defined by the Canadian Council of Forest Ministers.
- Provincial inventory reporting (MOF Annual Report).

Table 3. Forest management issues and the use of the VRI to address issues in the VFD.

	Issue[2]	VRI Implication		Remarks
		Photo-Interpretation	Ground Sampling	
1.	Inventory audit: assess forest cover, ecological, and recreation inventory data.	Required	Required	The inventory audit of the PG TSA completed in 1997 showed that the the mature volume in the VFD was accurate; the audit volume was 222 m^3/ha and the inventory volume was 236 m^3/ha. The VRI ground sampling could confirm these inventory results and adjust the inventory (Related IFPA project: "Vegetation resources inventory").[3]
2.	Problem forest types: monitor performance of very old balsam stands.	Required	Required	VRI information may help identify these stands.
3.	Deciduous stands: assess current inventory of deciduous stands.	Required	Required	Spatial data from the VRI could help with resource identification (Related IFPA project: "Deciduous stand inventory/successional study").
4.	Small diameter pine: assess site productivity and review management objectives.	Required	Required	The VRI may provide inventory and site productivity information for these stands. The NVAF sampling may provide adjustments to existing taper equations for forest-level inventory purposes. However, development of local taper equations for valuation cruising is the responsibility of MOF Revenue Branch (Related IFPA projects: "OAF analysis", and "Merchantability trial").
5.	Visual Quality Objectives: review approach for assigning forest cover requirements.	Not required	Not required	No impact
6.	OAF analysis: determine OAF values specifically for the VFD.	Not required	Not Required	The VRI accounts for OAF1. Reconciling of the VRI and timber supply netdowns should be resolved (Related IFPA project: "OAF analysis").
7.	Site productivity: conduct Predictive Ecosystem Mapping (PEM), paired-plot studies and SIBEC project.	Required	Required	The VRI may assist in auditing the site productivity maps, and site index sampling and adjustment (Related IFPA projects: "Predicted ecosystem mapping", "Local site index/paired plot project", and "Site index BEC project").

[2] BC Ministry of Forests, Timber Supply Branch. 1998. Prince George Timber Supply Area Timber Supply Review Data Package.

[3] List of IFPA projects provided by Avison Management Services Ltd. (Appendix II).

Issue[2]	VRI Implication		Remarks
	Photo-Interpretation	Ground Sampling	
8. Road and landing inventory: identify and classify roads for rehabilitiation.	Not required	Not required	The VRI accounts for existing roads, trails and landings (Related IFPA project: "Road and landing inventory").
9. Improved utilization: assess stump heights after harvesting and investigate methods for harvesting in Environmentally Sensitive Areas (ESA's) or scenic areas.	Not required	Required	Stumps are measured in the VRI ground sampling. However, more intensive sampling may be required in the harvested areas (Related IFPA project: "Improved utilization - proving stump height").
10. Stand-level biodiversity: assess Forest Practices Code requirements, including riparian areas and wildlife tree patches.*	Required	Required	Plant lists, forage production, lichen production and shrub transects from ground sampling could confirm base interpretations for wildlife. Improved photo interpretation could provide additional information to delineate wildlife habitat and protected areas (Related IFPA projects: "Vegetation resources inventory", "Riparian feature measuring project", and "Caribou habitat/pine lichen study"). See Appendix III.
11. Cariboo habitat/pine lichen: provide information on distribution of lichen woodlands.*	Required	Required	See Issue #10.
12. Central information hub: provide data for long-term Growth &Yield projects and other studies.	Required	Required	VRI data can provide another layer of information in an integrated database for use by stakeholders (Related IFPA project: "Central information hub").

* Please see Appendix III for more elaboration of Issues #10 and #11, plus additional issues from MELP.

2.3 Inventory Issues

The following inventory issues were identified in the Timber Supply Review Data Package:

1. The existing inventory is based on pre-VRI standards and requires upgrading.
2. Taper equations for Pl need to be localized. Preliminary studies indicate that existing taper equations appear to be biased in estimating small diameter Pl volumes (stocking class 3 and 4).

3. The old balsam age/height labels in the natural disturbance type 2 in the ESSF require revision. These include:
   - definition of "old".
   - age class 8/9 split.
   - problems with biodiversity guidebooks.
4. Gross losses from beetle infestations need to be quantified.
5. Species composition labels for deciduous stands are not consistently correct.
6. The spatial database needs to be moved to the TRIM 2 base map, which is used by government and major licencees in the Prince George Forest Region. This will facilitate data exchange and provide the advantage of "underlaying" the orthophotos with the spatial data themes for verification and authentication.
7. Existing information, such as the recently completed coarse-woody debris inventory, should be integrated into the VRI.
8. A 1997 PG TSA inventory audit, based on 31 samples, indicated that the difference between the audit volume (222 m^3/ha) and the inventory volume (236 m^3/ha) was not significant. VRI ground sampling followed by statistical adjustment could correct the small (6%) observed difference. The VRI may not be beneficial for other District inventories (Table 4).

Table 4. VFD Inventory Status.

Inventory Type*	Status		VRI Impact
	Vintage	Update	
Forest cover	1990-1993	1993-1997	The ground sampling would provide unbiased overall inventory, and the basis for statistical adjustment.
Biogeclimatic	1993	1996	The provincial VRI may help check the Biogeoclimatic Ecosystem Classification (BEC).
Natural distrubance type	1993	1996	None.
Visual landscape inventory	1994	1998	None.
Resource management zones (RMZs)	1996	1997	The VRI may help refine RMZs.
Protected areas	1996	1997	None.
Landscape units	1996	1997	None.
Lakeshore riparian area buffers	1997		None.
Caribou habitat	1995	1997	The provincial VRI may help refine areas of important Caribou habitat.
Woodlot update	1996	1998	None.

*Source: Prince George Timber Supply Area Timber Supply Review Data Package 1998.

2.4 Use of existing information

Some existing inventory information can be integrated into VRI activities through:

1. PEM mapping.
2. Planning ground sampling – determining sample sizes (e.g. inventory audit data).
3. Providing initial estimates (Phase I) (e.g. coarse woody debris data), which would be adjusted through ground sampling.
4. Developing reliability indicators for use in differential statistical adjustment to improve individual polygon values.

2.5 VRI Activities and Products

Tables 3 and 4 outline potential VRI activities and products to address some of the forest management issues in the District. These activities and products are summarized below:

1. Incorporate ecological and timber attributes into the District Phase I database using retrofitted photo-interpretation and data from other sources. This will support provincial and timber-emphasis inventories, habitat mapping, ecosystem mapping, riparian mapping, and other applications over the district.
2. Conduct timber emphasis ground sampling in the Vegetated Treed area of the District to provide statistically valid timber volumes and polygon-specific tree attributes, to support the timber supply review in the Prince George Timber Supply Area. The ground sampling will include Net Volume Adjustment Factor sampling to check loss factors and to develop new taper equations for PI (for valuation cruising)[4].
3. Conduct timber emphasis ground sampling in the deciduous stands in the VFD to improve species composition descriptions for these stands.
4. Conduct provincial VRI ground sampling throughout the VFD to provide baseline spatial and non-spatial data for timber and non-timber resources to support provincial Criteria and Indicators and inventory reporting, monitoring, and research (e.g. verify plant associations at risk).
5. Integrate the coarse woody debris (CWD) inventory data collected by Madrone Consultants Ltd. into the VRI database. (This objective was not discussed in detail at the stakeholder meeting).

These VRI activities and products will support the IFPA objectives and projects (Appendix II) and other resource specific interpretations (Figure 1).

[4] This objective will also be discussed with the MOF Revenue Branch.

3. STRATEGIC INVENTORY PLAN

3.1 Overview

This strategic inventory plan develops specific VRI products needed to address issues and considerations discussed in Section 2. The VRI products include timber-emphasis inventory in the Vegetated Treed (VT) area, and deciduous stands, and Provincial inventory (ecology, timber, and range attributes) over the entire District. These can be obtained through VRI photo interpretation, timber-emphasis ground sampling, Provincial (full VRI) ground sampling, and statistical adjustment. The implementation of these activities is assumed to be independent. Efficiencies could be achieved through joint implementation.

3.2 Photo-Interpretation

3.2.1 Objectives

The objectives are to incorporate ecological attributes into the District's Phase I database (to RIC standards) using photo-interpretation and to improve delineation and estimation of certain forest types.

The product is a spatial database consisting of unadjusted photo-interpreted estimates. Ground sampling to check and adjust the photo-interpreted estimates is discussed as a separate process (Sections 3.3 to 3.5).

3.2.2 Target Area

The District landbase (including any woodlots, parks, and proposed Protected Areas, but excluding private land) is the target area for populating the Phase I database with ecological attributes. The stakeholders will identify priority areas and strata during preparation of a VPIP for this project.

3.2.3 Target Attributes

Target attributes are listed in the VRI photo interpretation attribute form. All the attributes should be interpreted to VRI photo interpretation standards or obtained from other sources.

3.2.4 Photo-Interpretation Approach

The photo interpretation objectives could be achieved using a retrofit. This approach would fill the gaps between old and new standards by converting the existing database to a full VRI database and collecting missing data. The retrofit methodology will:

- Populate empty fields in the database using the original document photos, ortho-photography, or other relevant photography to interpret the attributes. Data from outside sources (e.g., PEM mapping) may be used.
- Address missing attributes, correct and upgrade existing attribute estimations, and identify significant errors or interpretation differences through field calibration

Issues related to retrofitting the existing inventory to VRI standards that will be discussed in a VPIP include:

- Filling gaps in the data,
- Identifying where new photographs are needed.

3.3 Timber Emphasis VRI – Vegetated Treed Areas

3.3.1 Inventory Objectives

The main objective of the timber emphasis inventory is to:

> *Install an adequate number of VRI Phase II sample clusters to adjust the timber inventory in the District VT areas, to achieve a sampling error of ±10% (95% probability) for overall net timber volume in these areas.*

Net timber volume is gross volume minus stumps, tops, decay, waste, and breakage. Decay and waste will be estimated using VRI call grading/net factoring and NVAF sampling. Breakage will be estimated using existing loss factors.

3.3.2 Target Population

The target population is the VT portion of the TSA, excluding any private lands, Protected Areas, and woodlots in the District.

3.3.3 Sample Size

A minimum sample size of 100 Phase II clusters is suggested. This should create a sampling error of ±10% (95% probability) for net timber volume in the VT area. This sampling error assumes a

Coefficient of Variation (CV) of approximately 50% based on the 31 inventory audit plots installed in the VFD as part of the 1997 PG TSA inventory audit.

3.3.4 Sample Selection

Sample polygons will be selected by the RIB using current sample selection methods and the existing Phase I file. Sampling points should have the same selection weights over the target population.

3.3.5 Sampling Approach

VRI Timber Emphasis Plots (TEPs) will be used to gather data following the current *VRI Ground Sampling Manual*. Field observations will include timber attributes, site series, and succession. Timber attributes and site series data will be collected in *all* the TEPs. Site series data will be used to confirm SIBEC correlations and check ecosystem and habitat mapping tools. Lichen (%cover) and succession data will be collected in the TEPs that fall in the pine-leading stands only; these data will be used to address the Caribou habitat/succession issues. All the TEPs will provide framework for additional sampling, such as the Provincial VRI (Section 3.6).

3.3.6 Net Volume Adjustment Factor Sampling

NVAF sampling involves detailed stem analysis of sample trees, calculation of actual net volume, and calculation of the ratio between actual net volume and estimated net volume (where estimated net volume is obtained from net factoring and taper equations). NVAF data is used to adjust the estimated net tree volume to account for hidden decay and possible taper equation bias (e.g. in pine stands). Sixty trees (50 live, 10 dead) selected from fifteen VT polygons (selected systematically from the Phase II sample clusters) will be destructively sampled for NVAF. These NVAF trees for pine, plus additional trees selected from the NVAF tree list, will also be used to develop local pine taper equations.

3.3.7 Within Polygon Variation Sampling

WPV sampling provides data to estimate the overall individual-polygon error. It is assessed as the difference between adjusted polygon value and "true" value for that polygon based on intensive sampling. Typically, 10 to 20 polygons selected from a target population are intensively cruised using a combination of 20 to 50 full measure and count plots per sample polygon. WPV sampling will not be implemented at this time. However, WPV sampling could be implemented as part of the Provincial VRI sampling (Section 3.6).

3.3.8 Implementation

The timber inventory should be coordinated with photo-interpretation work and could be implemented as follows:

- Step 1 – install a small batch of Phase II sample clusters (50) over the target population in the first field season (or first half of field season). This information would be used to refine the estimates of sample size.
- Step 2 – install remaining sample clusters in the second field season (or second half of field season).

A VPIP for the ground sampling should be developed following the guidelines outlined in the MOF document *Vegetation Resources Inventory Guidelines for Preparing a Project Implementation Plan for Ground Sampling.*

3.4 Timber Emphasis VRI – Deciduous Stands

3.4.1 Inventory Objective

The objective of this timber emphasis inventory is to improve information on the spatial timber distribution of deciduous stands in the District.

This requires improvements (re-typing) of these stands photo-interpreted estimates, ground sampling, and statistical adjustment of species composition. Photo-interpretation can be carried out as outlined in Section 3.2.

3.4.2 Target Population

The target population is all deciduous-leading stands (mainly Aspen) in the District VT database (approximately 87,000 ha; Table 2).

3.4.3 Sample Size

A minimum of 55 sample clusters should be installed in the target population. This sample size is based on a target sampling error of ±10% (95% probability) and an estimated CV of 37%[5] for net timber volume of the deciduous component in the population.

[5] This CV was estimated from the 9 PG TSA inventory audit plots that fell in the deciduous stands. It is the CV of the ratio of audit volume to inventory volume of Aspen (At). The ratio was 0.574 and the sampling error of the ratio was 0.1311 (95% probability).

3.4.4 Sampling Approach

VRI TEPs should be used to gather timber data following procedures in the current *VRI Ground Sampling Manual*.

3.4.5 Sample Selection

The RIB will select sample polygons using current sample selection methods and an existing or retrofitted Phase I file.

3.4.6 Net Volume Adjustment Factor Sampling

Twenty trees (18 live, two dead) selected from five polygons (selected systematically from the Phase II sample clusters) will be destructively sampled for NVAF.

3.4.7 Within Polygon Variation Sampling (WPV)

WPV sampling is not planned at this time.

3.4.8 Implementation

Polygon re-typing should be completed before ground sampling begins. All 55 samples should be installed in one step. A VPIP for the ground sampling should be developed following the guidelines outlined in the MOF document *Vegetation Resources Inventory Guidelines for Preparing a Project Implementation Plan for Ground Sampling*.

3.5 Coarse woody debris Inventory

3.5.1 Background

CWD inventory was not discussed in detail at the stakeholder meeting in February 2000. It has been included in this VSIP following discussions between Keith Tudor (MOF) and Bill LaForge.

An inventory of CWD by Madrone Consultants Ltd. has been ongoing in the District since 1997. The objective of this project was to provide a representative inventory of CWD resources in the major timber types in the District. Approximately 20 to 30 sites (distributed by age category) were selected subjectively[6] in each of six subzones of interest, resulting in a total of 153 sites. The subzones studied were: SBSdk, SBS dw2, SBSdw3, SBSmc2, SBSmc3, and EESFmv1. A 100-m

[6] Marnie Martin of Madrone Consultants confirmed that the study sites and the starting point of the grid were subjectively selected.

grid (400 m x 400 m) was overlaid on each site. CWD was sampled using the VRI methods at each grid intersection.

The CWD volumes were calculated for each site, age category, and subzone. The CWD volumes ranged from 42.6 m^3/ha in age classes 3, 4, 5, and 6 to 56.7 m^3/ha in age classes 7 and 8. The overall CWD volume was 52 m^3/ha, with a one standard deviation of 51.99 m^3/ha (CV = 98%).

3.5.2 Inventory Objective

The objective is to integrate the results of the recently concluded CWD inventory in the District into the District VRI database.

3.5.3 Proposed Integration Approach

The overall CWD volume estimates obtained by the recent inventory by Madrone are statistically biased, since the sites were subjectively selected. The magnitude and direction of the bias is not known; an independent ground sample would be required to determine it. However, the data could be used as initial estimates for individual polygons.

The CWD data could be integrated into the VRI database as follows:

1. Use the collected data to develop a model for distributing the CWD estimates for each polygon in the sampled subzones.
2. These polygon estimates would form the Phase I CWD estimates, which could then be adjusted after formal ground sampling.
3. Adjust the Phase CWD estimates and load into the VRI database.
4. The collected data could also be used to plan the formal ground sampling to adjust the initial estimates. The calculated overall CV is approximately 98%; the options for sample size based on this CV are shown in Figure 2. For example, to achieve a sampling error of 20% (95% probability), 100 transect clusters would be required.

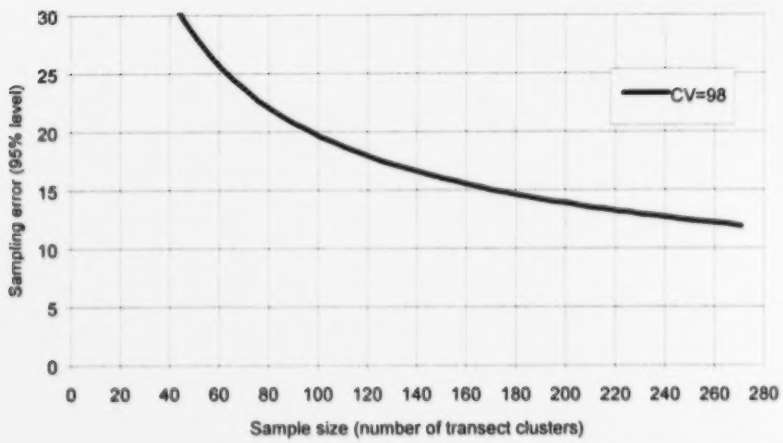

Figure 2. Sample size for coarse woody debris inventory in the Vanderhoof Forest District.

3.5.4 Implementation

The objectives and target population of this CWD inventory should be confirmed with the stakeholders, since these issues were not formally discussed at the stakeholder meeting. A VPIP for the CWD ground sampling should then be developed following the guidelines outlined in the MOF document *Vegetation Resources Inventory Guidelines for Preparing a Project Implementation Plan for Ground Sampling*. This CWD inventory could be integrated with other sub-unit VRIs, e.g., timber emphasis VRI (Section 3.3).

3.6 Provincial VRI Ground Sampling

3.6.1 Objective

The main objective of the provincial VRI is to:

> *Install an adequate number of VRI Phase II sample clusters in the entire District landbase, to collect data on timber, ecology, and range resources for provincial reporting. The provincial sampling aims to achieve a sampling error of ±15% of net volume in the VT areas.*

3.6.2 Purposes

A full VRI provides spatial and non-spatial baseline timber and non-timber resources data for the District. A full VRI District ground sampling program would include:

1. Additional ground sampling of the non-vegetated and vegetated non-treed areas.
2. Upgrading some TEPs to full VRI status in the VT areas.

3. NVAF (in addition to timber-emphasis inventory) and WPV sampling.
4. Enhancing MOF ground samples as part of the National Forest Inventory (NFI) in BC.[7]

Full VRI information would provide:

1. A basis for calculating unbiased overall averages and totals for timber and non-timber vegetation resources for the District landbase.
2. Initial conditions and locations for measuring District-level changes and trends in sustainable forest management indicators. These can provide a statement of sustainability of District forest practices.
3. Baseline data to develop Site Index Biogeoclimatic Ecosystem Classification (SIBEC) and other correlations and to check ecosystem and habitat mapping tools.
4. Baseline data to confirm non-forest BCLCS classification and District biodiversity guidelines.
5. Additional information on non-timber resources (e.g., plant lists) indicating where more intensive sampling could improve estimates for specific plants (e.g., medicinal plants) and botanical products.

3.6.3 Target Population

The target population is the entire District landbase including vegetated and non-vegetated areas, and any Protected Areas, woodlots, and private lands.

3.6.4 Sampling Unit

Full VRI sample clusters will be installed using the current version of the *VRI Ground Sampling Manual*. Measurements will include tree attributes, plant lists and percent cover, ecological site description, soil description, old-growth designation, coarse woody debris, and range resources.

3.6.5 Sample Size

A minimum of 50 full VRI samples is suggested, with approximately 40 samples falling in the VT area.[8] This would create a sampling error of approximately 15% for net timber volume in the VT landbase (based on a CV of approximately 50%). Additional plots from the timber emphasis VRI could reduce the VT-area sampling error for net volume to ±10% for the District (Section 3.3).

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[7] The provincial NFI establishes 314 ground plots throughout the province on the national 20-km grid to contribute information on provincial resources to the national database providing the Federal Government with a consistent framework for reporting on Canada's inventory. Some of these ground plots will fall in the VFD. The ground plot locations can be obtained from the Canadian Forest Service, Victoria (Mark Gillis).

[8] We assumed that the VT area is approximately 85% of the District landbase.

3.6.6 Sample Selection

Sample polygons will be selected by the RIB using current sample selection methods and the existing Phase I file. Sampling points will be selected with equal probability across the District landbase.

3.6.7 NVAF and WPV Sampling

NVAF and WPV sampling are required to complete the Provincial VRI. They should be conducted as outlined in sections 3.3.6 and 3.3.7. The NVAF described in section 3.3.6 is only applicable to the VT TSA area excluding any private lands, parks, and woodlots. For the provincial VRI, another NVAF is needed in the remaining areas of the District landbase, including the District Non-Vegetated and Vegetated Non-Treed areas and any VT areas in private lands, parks, TFLs, and woodlots. Ten trees (8 live, 2 dead) are needed in these areas.

3.6.8 Implementation

Sampling should be implemented across the District in one step to achieve Provincial VRI objectives. A VPIP for the ground sampling should be developed following the guidelines outlined in the MOF document *Vegetation Resources Inventory Guidelines for Preparing a Project Implementation Plan for Ground Sampling.*

3.7 Implementation Priorities

The VFD will work with stakeholders to identify project implementation priorities. A Provincial VRI and timber-emphasis VRI may be implemented by smaller units (e.g., Landscape Units or Supply Blocks) identified at the District level by the stakeholders. Districts in the PG TSA may want to jointly implement programs where there are common interests.

The stakeholders will develop VPIPs for the priority projects, based on this VSIP. The VPIPs will identify inventory activities, prioritize areas, annual costs, and roles and responsibilities for implementation. They will link VRI to other Regional FRBC-related (or other agency) initiatives.

3.8 Costs

Estimated sample sizes and costs for the District VRI activities are listed in Table 5. More accurate and detailed costs should be included in the VPIPs. These costs exclude the cost of the CWD inventory, since the inventory objectives and target population have not been confirmed.

3.9 Monitoring

The RIB is responsible for monitoring this VRI planning process and ensuring that the final VSIP is approved (Appendix IV).

Table 5. Estimated sample sizes and costs for VRI in the VFD.

VRI ACTIVITY	Sample size (plots)	Unit Cost ($)	Total Cost ($)
PHOTO INTERPRETATION			
a) **Photo retrofit**	1,197,480 ha[9]	0.75/ha[10]	898,110
GROUND SAMPLING			
b) **TEP– Vegetated Treed**[11]			
Phase II Cluster	100	1,200	120,000
NVAF sampling (trees)	60	400	24,000
Total TEP - VT			*144,000*
c) **TEP – Deciduous**[12]			
Phase II Cluster	48	1,200	57,600
NVAF sampling (trees)	15	400	6,000
Total TEP - Deciduous			*63,600*
d) **Provincial VRI** [13]			
Phase II cluster (Full VRI)	10	1,500	15,000
Phase II upgrade TEP	40	1,200	48,000
NVAF sampling (trees)	10	600	6,000
WFV (polygons)	30	2,400	72,000
Total Provincial VRI			*141,000*
e) **Ground sampling**			
Quality assurance (10% of total ground sampling cost)[14]			34,860
Project management (20% of ground sampling cost)[15]			69,720
Statistical analysis			20,000
Total (Photo Interpretation and Ground Sampling)			***1,371,290***

[9] The VFD forested landbase (Table 1), which is approximately 106 mapsheets; costs will be reduced if private land is excluded.

[10] This retrofit cost could range from $0.75/ha to $1.00/ha, and excludes cost of photography. In comparison, the cost of new photo-interpretation is approximately $1.60/ha.

[11] Timber Emphasis VRI ground sampling.

[12] These costs are incremental to the TEP-Vegetated Treed ground sampling needed to increase volume precision in this sub-unit.

[13] The provincial VRI sample sizes are incremental samples needed to upgrade the timber emphasis VRI to full VRI status.

[14] Quality assurance is done by a check-cruiser, and it involves checking 10% of the field crew work using the MOF quality assurance procedures and standards.

[15] Actual project management costs will vary by project and how projects are managed (e.g., projects may be managed in-house).

APPENDIX I – GLOSSARY OF TERMS

Ground Sampling

Ground sampling is the field measurement of timber, ecology, range, and/or coarse woody debris values at one or more locations within each sample polygon. Sample polygons are selected proportional to their area from a sorted list. To accommodate a wide variety of resources, various types and sizes of sampling units (e.g., fixed and variable plots, transects) are used to make the measurements.

Inventory Unit

An inventory unit is the target population from which the samples are chosen. For the provincial VRI, the inventory unit is the Forest District, which includes the timber harvesting landbase, parks, recreational areas, private, and federal lands. For management inventories, the inventory unit is a subset of the provincial VRI inventory unit that focuses on a geographic area or specific attribute set, depending upon sampling objectives.

Landcover Classification

The BC Land Cover Classification Scheme (BCLCS) was designed specifically to meet VRI requirements, in addition to providing general information useful for "global vegetation accounting" and "integrated resource management." The BCLCS is hierarchical and reflects the current state of the landcover (e.g., presence or absence of vegetation, type and density of vegetation) and such fixed characteristics as landscape position (i.e., wetland, upland, alpine). There are two main classes of polygons: Vegetated and Non-Vegetated.

Management VRI

Management VRIs are specialized inventories that provide detailed information required for specific resource management, i.e., day-to-day forest management. One or more VRI sampling procedures may be used for management inventories. Management inventories may focus on specific resource types (e.g., timber, range, ecology), geographic areas (e.g., landscape unit, TFL), attribute sets (e.g., Douglas-fir leading stands, age class 4+). They may use one or more of the following tools (e.g., photo-interpretation, ground sampling, NVAF sampling).

National Forest Inventory (NFI)

The NFI provides information on Canada's resources across all provinces and allows the Federal Government a consistent framework for reporting on Canada's inventory. The inventory unit for the NFI is the entire country, although it is implemented province-by-province.

Net Volume Adjustment Factor (NVAF) Sampling

NVAF sampling provides factors to adjust net tree volume estimated from net factoring and taper equations. The adjustment accounts for hidden decay and possible taper equation bias. NVAF sampling involves detailed stem analysis of sample trees, calculation of actual net volume, and calculation of the ratio between actual net volume and estimated net volume (where estimated net volume is obtained from net factoring and taper equations).

Photo-Interpretation

Photo-interpretation involves subjective delineation of polygons and photo estimation of attributes for all polygons in an inventory unit. Medium scale aerial photographs (1:15,000) are most often used in photo-interpretation. However, if existing photo-based inventory is acceptable, the database can be translated into VRI format and upgraded to include the additional VRI attributes.

Post-Stratification

Post-stratification involves dividing inventory unit into mutually exclusive sub-populations (strata) *after* ground sampling has been completed. Samples that fall in each post-stratum are analyzed separately and the results are applied to the corresponding population post-strata to improve the precision of the inventory's overall averages and totals.

Pre-Stratification

Pre-stratification divides an inventory unit into mutually exclusive sub-populations (strata) *before* ground sampling to provide estimates for specific areas, or to increase the confidence in the overall estimates by considering special characteristics of each stratum.

Provincial VRI

The provincial VRI provides baseline data for provincial inventory reporting, monitoring, and research. All sampling procedures from the VRI toolbox are used for this inventory at the Forest District level. The databases generated from each District inventory will be compiled to create the provincial VRI database. The provincial VRI has also been referred to in the past as the District VRI.

Resource-Specific Interpretations

Resource-Specific Interpretations (RSI) use the Resource Inventory Committee (RIC) standard VRI baseline data products (provincial VRI or management inventory), in combination with other data sets and analysis (outside of that required to produce VRI), to produce information to address specific-resource management issues (e.g., TSR review, important ecosystems, important habitats). These interpretations include ecosystem interpretations and habitat interpretations.

Retrofit

Retrofitting is the process of translating and upgrading an existing photo-based inventory to VRI standards. If the polygon linework and attributes are of acceptable quality, the existing FIP (Forest Inventory Planning) databases are translated to VIF (Vegetation Inventory Files) databases and the additional attributes required by the VRI are re-estimated from aerial photographs.

Sample Size

The sample size for an inventory is the minimum number of ground samples to be established in an inventory unit to meet the target precision.

Statistical Analysis

Statistical analysis is the process of adjusting the values of the photo-interpretation variables using ground-sampling observations. For each sampled polygon, ground observations are compared to photo-estimated values to develop an adjustment factor. This factor is then applied to all polygons in the photo interpretation database to produce the final adjusted database.

Sub-unit

Sub-unit describes the inventory unit of a management inventory (i.e., the management inventory target population is a subset of the provincial VRI inventory unit). A sub-unit may be defined by a specific geographic area (e.g., operable landbase) or stand type (e.g., problem forest types) within the Forest District.

Target Precision

Target precision expresses the amount of variation in key attributes (e.g., timber volume) desired in the final results. Target precision, usually expressed as the coefficient of variation (CV), is used to calculate the minimum sample size for subsequent ground sampling.

Vegetation Resources Inventory (VRI)

VRI is an improved vegetation inventory process for assessing quantity and quality of BC's vegetation resources. The VRI process is designed to include a flexible set of sampling procedures for collecting vegetation resource information. The VRI is essentially a toolbox of procedures, which include:

- *Photo-interpretation*: the delineation of polygons from aerial photography and the estimation of resource attributes.
- *Ground sampling*: the establishment of plot clusters in selected polygons to measure timber, ecological, and/or range attributes.
- *NVAF Sampling*: stem analysis sampling of individual trees for net volume adjustment.
- *WPV Sampling*: intensive sampling of selected polygons to determine the error between the estimated attribute values and the "true" attribute values.
- *Statistical Adjustment*: the adjustment of the photo-interpreted estimates for all polygons in an inventory unit or management unit using the values measured during ground sampling.

The VRI can be deployed over the entire province (provincial VRI) measuring timber and non-timber resources, or over a large management unit (management VRI) measuring selected resources in specific portions of the landbase. The VRI sampling process produces spatial and non-spatial databases that can be used in multiple resource management applications including timber, ecosystem, and wildlife habitat management.

Within Polygon Variation Sampling

WPV sampling provides information for expressing the true individual polygon error, assessed as the difference between the adjusted polygon value and the "true" value for that polygon. The "true" value for the polygon is an estimate derived from a small sample of polygons that are intensively sampled on the ground.

APPENDIX II – LIST OF VFD IFPA PROJECTS

The following text, which consists of a preliminary list of the Vanderhoof IFPA projects, was provided by Bill LaForge of Avison Management Services Ltd.

- **Project Description- Vegetation Resources Inventory**

Both the Vanderhoof IFPA Licensee Group and the Public Advisory Group have identified VRI as a top priority project.

Ground sampling can concentrate on one or many attributes of a given area, depending on the priorities of the VRI. The VRI for the Vanderhoof IFPA will collect information on many different attributes at each sample site. Each site will collect timber emphasis information as well as ecosystem classification information. Using the latest list of species at risk and plant associations at risk, the VRI will collect information at each sample site to verify the presence or absence of these species. Using areas identified as critical habitat in the Vanderhoof LRMP, the VRI will sample for large ungulates such as moose, deer, etc. Another attribute sampled under this VRI is Environmentally Sensitive Areas (ESA) information. This information can be used to confirm and refine the existing ESA classification in an area. Information gathered through the VRI will include attributes identified in a gap analysis completed prior to the VRI. This gap analysis will ensure that attributes required for certification are part of the VRI.

The size of the whole VRI process prevents it from being completed in a single year. The Vanderhoof IFPA is targeting a three-year time frame for completion.

- **Project Description- OAF Analysis**

Since they account for a land base netdown (reduction of productive forest land), it is important to determine an OAF values which are truly representative of the Vanderhoof IFPA land base. By proving smaller OAF values through sampling, the Vanderhoof IFPA can reduce some of the downward pressure on AAC. From the forest inventory, forest strata will be constructed according to the definitions used in timber supply. A sampling plan will be developed based on stratified random sampling. OAF2 adjustments address losses due to factors such as disease and insects, which tend to increase with time. Determining OAF2 adjustments involves a longer term, and involves destructive sampling.

Taper equations are used to predict tree volumes. These equations are compiled through stem analysis where many sample trees are cut into small sections for measurement. By increasing the samples from within the Vanderhoof Forest District, the taper equations can be localized to more closely reflect local growing conditions.

Project Description- Deciduous Stand Inventory/ Successional Study

This project intends to GIS theme the current forest cover inventory for both pure deciduous and deciduous leading stands (approximately 88,200 ha across the Vanderhoof IFPA area). Then complete a field verification of all or a statistically valid subset of target stands described above. To complete the project, a project summary and attendant tabular reports will be provided that more accurately quantify the pure and deciduous leading stands as well as their conifer content. These reports will be referenced to existing inventory information to determine the changes to these stands through time. The result will be the ability to predict the levels of deciduous leading stands and allow for management of these levels for many different stakeholders. The objectives of this project are to assess the accuracy of the current inventory to better quantify the deciduous component and conifer content within those stands previously, and currently identified as pure deciduous and deciduous leading in the Vanderhoof IFPA and provide this information to resource analysis.

Project Description- Predictive Ecosystem Mapping

The PEM project goal is to complete a set of ecosystem maps for the Vanderhoof IFPA. The importance of this project is reflected in the noticeable shift in recent years from timber-based management to ecosystem management. Final ecosystem mapping products will ensure that strategic and operational planning requirements can be met as they relate to using Site Index Biogeoclimatic Ecosystem Classification (SIBEC) to adjust productivity estimates and also to Forest Practices Code (FPC) needs. The utility of this project lies in the many resultant interpretive and planning products that are derived from an ecosystem map. One direct benefit will be the use of the ecosystem maps for analysis of forest productivity. It is anticipated that there will be demonstrated gains in tree growth that would result in alleviating downward pressure on the AAC. An ecosystem classification will also allow a meaningful approach to the management of biodiversity and wildlife during timber supply analysis. Accurate defensible ecosystem data provides a better quantification of wildlife values and will ensure their management in a specific and appropriate manner.

Project Description- Road And Landing Inventory

The Timber Supply Review process uses assumptions on the area of forest land occupied by permanent access structures. The licensees of the Vanderhoof Forest District have been minimizing the building of roads and landings, and want to prove that the number used for the Timber Supply Review is too high. By using TRIM 2 ortho-photos and a ground sampling regime, the IFPA will get an accurate inventory of road widths and road class, as well as general road condition information.

Project Description- Road And Landing Rehabilitation Project

Rehabilitation of roads and landings reduces the amount of forest land occupied by access structures and returns this land to productive forest. This project will rely heavily on information gained through the Road and Landing Inventory. The rehabilitation of forest roads requires a detailed plan for the treatment as well as an analysis of the costs and benefits. The project will be split up into phases, phase one will be identifying and field verifying potential rehabilitation sites, phase 2 is the physical rehabilitation work, phase 3 will be the planting of these rehabilitated sites. The final phase is to build field visits into the regular survey visitation requirements of a cutblock to assess growth and performance of the trees. The first three phases of this project are designed to occur over two years, with the final phase stretching over several years. The fourth phase will also assist in assessing different techniques for rehabilitation through the assessment of crop tree performance.

Project Description- Improved Utilization (Proving Stump Height)

Recent trends to mechanized harvesting have been shown to achieve a stump height consistently shorter than 30 centimetres. The Licensees of the Vanderhoof IFPA feel that they are exceeding the requirement and that this shorter stump height should be considered in the Timber Supply Review for the Forest District. This project will involve field surveys to measure blocks harvested across all seasons by each of the IFPA licensees. A system of stratified systematic sampling will be designed to ensure statistically valid data collection.

Project Description- Cultural Heritage Studies

Cultural heritage features are often poorly identified, either on maps or on the ground. Through input from the First Nations within the Vanderhoof IFPA area, each year studies of cultural heritage features will be undertaken. These studies will look at locating,

classifying, and developing a management strategy for cultural heritage and archaeological features. There is a strong linkage between this project and the LRMP. By providing a yearly budget for cultural heritage projects, the IFPA looks to address some issues surrounding these resources. This budget may be spent in any number of functions, from GPS locating trails and other features, to building data bases of gathered information, to fixing cultural trails. Potential projects will be solicited from First Nations and other cultural organizations. It is understood that some First Nations may have confidentiality concerns regarding having traditional or sacred areas mapped. These concerns will have to be mitigated through controls on who holds, and who sees the information gathered.

Project Description- Value-Added Retrospective Studies

This project looks to strengthen the value-added industry in the IFPA area through review of all existing value-added studies, as well as investigating the operation of log yards, and log markets. This project will also investigate the existence of a small log merchandiser. This project will look to research and develop a machine if none exists.

Project Description- Local Site Index/ Paired Plot Project

The objective of this project is to conduct a localised Paired Plot Site Index study in the Vanderhoof IFPA area. A recent provincial study called "OGSI" (Old Growth Site Index Adjustment) demonstrated significant differences in site index estimation by establishing paired plots in logged and regenerated areas adjacent to old growth stands. While the study demonstrated the disparity in site index estimation for spruce and pine it did not cover sufficiently the range of site conditions and sampling intensity for all commercial species across the range of sites necessary for localised estimations within the Vanderhoof District. This project is intended to extend the paired plot study in the Vanderhoof District for commercial species under represented in the provincial OGSI program. Information from provincial data sets and a gap analysis will identify where paired plots are required. The Vanderhoof IFPA Paired Plot Program is linked directly to the MoF Provincial OGSI Program. Information from the IFPA will augment and help bolster provincial site index adjustments. Additionally, site index information from this program will be useful in applying to the SIBEC (Site Index Biogeoclimatic Classification) program. Plot data and criteria for SIBEC sampling will be met within this Paired Plot Program.

Project Description- Genetic Improvement Project

Using a seedling that achieves Free-Growing and Green-Up more quickly, as well as producing more volume at culmination age would be a valuable tool for Licensees. The short-term objective of this project is to prove the increased early growth of these genetically improved trees. This will be done by accepted scientific methods using control plots as well as comparisons across blocks with similar site conditions. The Vanderhoof IFPA will also keep in contact with other IFPA holders around the province, and keep current with their progress.

Project Description- Partial Harvest Trials

The goal of this project is to investigate and implement a trial to harvest within scenic or ESA areas. There will be opportunities to capture decadent wood in select Spruce, Pine and Fir stands. The objective of this activity is to increase the AAC derived from the IFPA on scenic areas or environmentally sensitive areas. This will be achieved by developing the strategy, criteria and methodology for harvesting effectively in areas that are governed by non-timber values.

The harvesting trials are to be designed in areas representing these particular values, and will be analyzed with the key objectives demonstrating the following

- non-timber values can be maintained,
- significant timber volumes can be economically harvested, and
- the experimentation is silviculturally sound.

The successful implementation of partial harvest and silviculture system will improve the timber supply utilization of the IFPA District Land Base without compromising other values. The short-term effect will be the offsetting of downward pressures on the timber supply and increasing the AAC in the long-term.

Project Description- Wildlife Tree Patch Use and Location Study

By studying the use of a variety of existing WTPs we can predict the most effective WTP locations for certain attributes. This project will make recommendations on the best location for WTPs, in many cases these may already be set aside under other requirements. If WTPs

can be tied together with existing features, their impact on the overall Timber Harvesting Land Base will be lessened. This project will identify the best locations for WTPs and prove that put in their best locations, WTPs have a smaller impact on the Timber Harvesting Land Base than what is assumed in the TSR. The project will involve studying the use of current WTPs as well as the use of other riparian features. The IFPA will also liaise with the Ministry of Environment, Lands and Parks to determine the best WTP attributes.

- **Project Description- Long Term Growth and Yield Project**

This Program is designed as a long-term IFPA Growth and Yield program aimed at providing the IFPA with more precise predictions on forest growth and yield. Consistent with the provincial objectives the IFPA is committed to providing a growth and yield data and information program that will accurately reflect the growth and yield of the IFPA area. The success of this program not only depends on the amount of accurate data but also in how the data is used in terms of growth modelling. This particular activity of the IFPA will act as the umbrella program for all other growth and yield initiatives. This program will ultimately be responsible for:

1. Long-term growth and yield plan,
2. Growth and yield information gathering through permanent and temporary plot establishment.
3. Growth modelling and prediction (includes products such as "yield curve adjustments"), and
4. Long-term growth and yield monitoring and other growth and yield products to be defined in the Long-Term Growth and Yield Plan.

The field data measurement of this project will be ongoing through the life of the IFPA. The Vanderhoof IFPA Long-Term Growth and Yield Program is linked to all growth and yield related activities on the IFPA, the Provincial Growth and Yield Program, and other potential programs requiring growth and yield information.

- **Project Description- Riparian Feature Measuring Project**

The objectives of this project would be to review and assess the current ESAs strictly and uniformly according to the ESA standards outlined in the Forest Inventory Manual. The strategy is to review the ESAs in the district inventory (including their correct application, broadness of application and consistent application) across the district. This project will be undertaken as part of the Vegetation Resources Inventory.

Project Description- Scenic Area Boundary Study

A correct and up to date inventory of the visible landscape in BC, is becoming more important as society's values and priorities change. To address concerns over the current delineation of visual sensitivity units (VSUs), considered to be too large and overlapping and their respective visual sensitivity classes (VSCs), considered to be defaulted to the highest class, an assessment and update of the current visual landscape inventory is in order.

Any such assessment would involve both field and offices phases to assess the current Visual Landscape Inventory (VLI), while updating VSU boundaries and VSCs according to the most current standards.

The objectives of this project would be to review and assess the current VLI to the current standards through office and field verification processes, providing a report on the validity of the current delineation and classification to either substantiate or refute the current VLI. To complete the process and produce a new VLI, (should the assessment confirm the feelings about the current VLI), would require a relatively minimal additional effort.

Project Description- Caribou Habitat/ Pine Lichen Study

Fire is the most common natural disturbance process which affects sustained reproduction of lodgepole pine forests (Tande 1979). Seral stages after fire in lodgepole pine forests included a stage of terrestrial lichen dominance from 80 to 130 years, after which time pleurocarpous mosses such as *Pleruozium schreberi*, *Hylocomuim splendens* and *Ptilium crista-castrensis* show increasing dominance. The fruticose lichens *Cladina mitis*, *C. rangiferina, Cladonia uncialis*, and *Stereocaulon alpinum* are amoung the main lichen species in these mature lodgepole pine stands (Brulisauer et al. 1996). One common speculation for this shift in forest floor plant community structure is the result of changing tree canopy dynamics. In more northern lichen woodlands (NWT and Yukon) canopy closure has been attributed to the change (Kershaw 1978). In the Omineca-Germansen region of British Columbia this proposal has been considered too vague and the shift is attributed to a function of increasingly large trees being more efficient at absorbing solar radiation than young ones (Coxson et al. 1999). The Laidman area of the Vanderhoof Forest District has large areas of lichen woodlands, which are imported habitat for woodland caribou. These sites show similarities to sites studied in the Omineca-Germansen, however.

slight differences may occur. The Omineca-Germansen is influenced by a more continental boreal climate. As a result, it has a cooler annual temperature, which may provide for greater moisture availability. This project will utilize TRIM 2 and ortho photos (1996) base maps which will show all roads. Outputs from the roads and landing inventory project can be used for future resource analyses by providing a detailed road classification complete with road widths provided through field sampling. Patterns of succession have been identified for the Omineca-Germansen region by Coxson et al. (1999). These are useful as a guide to identify seral distribution strategies for lichen woodlands but in turn may provide a less than accurate target given the slight variances in climatic conditions. Information, similar to what was collected under the Coxson et al. (1999) study needs to be collected for the Laidman area. With this done, accurate targets may be established which will aid natural resource management in the area. At the present time resource managers of wildlife and of forests have difficulty setting targets for the most desirable seral stage distributions for their respective resources. This is largely due to a lack of available information regarding lichen woodlands in the Laidman area.

This study will provide a more detailed and comprehensive data base within the Vanderhoof Forest District to allow for better management decisions in setting targets around seral stage distributions and respective resources.

Project Description- Site Index Biogeoclimatic Ecosystem Classification Project

The importance of site productivity is reflected in the notable shift in recent years from broad-based species application of site index to an ecosite-specific approach. Site productivity estimates in the form of site index information will be collected to bolster the current Provincial Site Index - Biogeoclimatic Ecosystem Classification (SIBEC) database. SIBEC estimates will have utility in assigning site index estimates to bare ground or old growth stands where site index is no longer accurately reflected in height growth of older slower growing trees.

The efficient application of a SIBEC program is best suited to an area where an ecological site series has been conducted. In this way, strata based sampling can proceed based on a quantitative analysis of species and site series. Additionally, future products based on this formation, such as site productivity maps, will help forest mangers develop prime site management strategies.

The objective of this project is to conduct an ecologically based inventory of site index, and would be implemented over a two year period.

Efficient SIBEC programs rely heavily on the availability of an ecological inventory for both the collection and application of site index information. Therefore it is recommended this project be scheduled after PEM mapping completion. The random locations of plots adhering to strata based sampling will help assign appropriate site index values

Information from provincial data sets and a gap analysis will identify where paired plots are required. Potential plot locations will be identified and screened through various field and office procedures. Located plots will be measured the following year. Data synthesis and analysis will then provide localized old growth site index adjustments for previously identified strata. The Vanderhoof IFPA SIBEC Program is linked directly to the MoF Provincial SIBEC Program. Information from the IFPA will augment and the provincial SIBEC database.

Project Description- Early Stand Height Growth

The ability to predict growth in young stands is a very important planning tool. As Licensees rely on "second pass" harvesting more and more, green-up becomes a larger Timber Supply constraint. Silviculture techniques look to minimize Free-Growing and Green-Up ages. Currently there is very little Growth and Yield (G&Y) information on young managed stands.

The objectives of this project are to provide accurate growth curves for stands under 30 years and to increase the volume of growth and yield data for managed stands. This project has a strong linkage to Timber Supply Reviews. It also links to the long-term G&Y, the genetic improvement project, as well as the SIBEC project.

Project Description- Retrospective Studies

In many situations the need for statistical rigour in designing experiments for prospective studies is far too costly. Retrospective studies possess the potential to extract valuable information from a wide variety of sources in a much shorter time period. This project is intended to canvass the other Vanderhoof IFPA projects with respect to project objectives, process flow, data requirements and deliverables. Essentially, the IFPA project profiles are compared and data requirements are documented. From this point, other data sources not previously considered may be assessed for their utility in addressing specific project

objectives. Based on the findings of other sources of information, recommendations can be made for proceeding with future data collection and/or data analysis.

Project Description- Merchantability Trial

This project is designed to look at the potential of harvesting small diameter pine stands for use in the value-added industry. These stands are below 10 centimetres in diameter at stump height, and are below the harvesting specifications of existing Forest Licenses in the Vanderhoof Forest District. Stands of this type exist in the VFD due to the high level of Natural Disturbance Type 3 (NDT 3). If these stands are harvested and regenerated, it can be assumed that the regenerated stands will yield greater volumes at the next rotation and add to the stable long term Timber Supply in the VFD.

Once the stands are selected, they will be cruised to a high level of accuracy to develop accurate stock tables, piece sizes, and volume. The harvesting trial will determine what techniques are most effective and economically feasible. The value of the resultant raw material will also be determined.

Project Description- Central Information Hub

This project will look at various Information Management Systems to determine the most appropriate for the Vanderhoof IFPA. This information hub will gather all data for the various Development Plans, Resource Inventories and other GIS data. A key priority of this project is to ensure information is submitted, and available, in a common format and to defined data entry standards. This project is the link between all other IFPA projects, as well as operations of all IFPA licensees.

APPENDIX III – MELP ISSUES STATEMENT

The following text was provided by Ron Kot of MELP.

Inventory issues raised in the Forest Resources Commission (FRC) 1991 report included a lack of statements on the precision of the timber inventory; inadequate information on non-timber vegetation; lack of reliable estimates of growth rates and stand-specific volumes; lack of information on parks and other reserved areas; and the narrow focus on commercial timber volume and the timber harvesting landbase. Developing VRI baseline inventory products and undertaking subsequent, VRI-based, resource-specific information products development, and using these in decision processes, leads to addressing the information gaps identified by the FRC. FRBC funding and RIC standards development is leading to addressing the issues raised by the FRC.
How VRI generally supports addressing a range of MELP issues is first noted below. Then specific issues are noted, in terms of priority issue areas. MELP issues apply generally wherever development occurs. The spatial context needed to address MELP issues is often larger than specific development areas, requiring proactive inventory and assessment over contiguous inventory blocks, in areas scheduled for development. Parks management requires information on ecosystems and habitat. Wherever VRI inventories are planned adjacent to parks, the inventory should be carried into the parks so the larger spatial context for park and adjacent lands management can be brought together. This allows land management treatments and strategies to protect environmental values to recognize the contribution of parks and protected areas to planning management of the land base in the Forest District as a whole.

Table 6. Ecology and environment issues.

Issue	Phase 1 Photo-Interpreted Estimates	Phase 2 Ground Sampling	Remarks
1. GENERAL. Better information is needed to identify and protect important ecosystems and habitats for red and blue listed species, key ungulates and other regionally significant species.	Needed	Needed	VRI Photo Estimated inventory products result in improved polygon delineation over old forest cover mapping and include additional attribute data needed to support a range of interpretations (e.g. ecosystem, habitat, forest productivity) to address land planning issues. The Photo Estimation Phase provides the spatial inventory needed

	Issue	Phase 1 Photo-Interpreted Estimates	Phase 2 Ground Sampling	Remarks
	Information is needed for Forest Practices Code land management planning decision processes: **LRMP** (resource management zones delineation and management prescriptions); descriptions; **Landscape Unit Planning** (landscape unit biodiversity, biodiversity emphasis options, seral stage distribution across the landscape); **Stand level biodiversity** (riparian area designation, wildlife tree patches, coarse woody debris levels, seral stage distribution, ungulate winter ranges).			to address spatial issues associated with comprehensive land planning. VRI Ground Sampling inventory products provides plot attribute data needed to support the interpretations mentioned above. The sampling design employed (plot types and distribution) affects the degree of plot support for ecosystem, habitat mapping and SIBEC. Some supplemental sampling may be needed to pick up areas missed. Plot types V, or E and Z support ecosystem mapping. V, or E, Z,Q,C and T support habitat mapping.
2.	Caribou Habitat. Laidman RMZ is a priority area. Mainly associated with pine types.	Needed	Needed	VRI Phase 1 needed to interpret caribou habitat using a range of VRI attributes that contribute to caribou habitat. VRI Phase 2. Sample type Q + Z: Add card 15 - notation of ground lichen presence and % cover
3.	Rare plant associations: 3 red-listed plant associations: Bluegrass – Slender Wheatgrass PA Saskatoon – Slender Wheatgrass PA Black Cottonwood / Red-Osier Dogwood – Prairie Rose PA 1 red-listed vascular plant (Weak Alkali-Grass)	Needed	Needed	VRI Phase 1 provides polygon base for ecosystem mapping. VRI Phase 2 provide plot data to support ecosystem mapping. Use VRI-based ecosystem mapping as a coarse filter interpretation to identify areas of potential for these occurrences, and conduct follow up inventory.
4.	Grizzly Bears. Forest District habitat mapping with primary issue areas are:	Needed	Needed	VRI Phase 1 provides polygon base for ecosystem mapping. VRI Phase 2. No specific stratum identified. Use stratum sampled with

	Issue	Phase 1 Photo-Interpreted Estimates	Phase 2 Ground Sampling	Remarks
	Finger/Tatuk, Nulki Hills, Crystal Lake and Targe Creek Subzone areas.			plot types Q, V and Z, put in to address other issues. Supplement later with post VRI sampling.
5.	Old Growth / Biodiversity guidelines for the Forest District. Priority area - the ESSF zone in the southwest portion of the district.	Needed	Needed	Better identification of old growth from VRI to answer the timber age question (250 year for old). Potential to use VRI to define old growth based upon attributes in addition to age. Q, V, Z.
6.	Mule Deer. Forest District habitat mapping with primary issue areas are: North Chilko and Bobtail areas	Needed	Needed	VRI Phase 1 provides polygon base for habitat mapping. VRI Phase 2 plots support VRI-based habitat mapping. No specific stratum identified. Use stratum sampled with plot types Q, V and Z, put in to address other issues. Supplement later with post VRI sampling.
7.	Seral Stage Diversity for Biodiversity implementation	Needed	Supportive	VRI Phase 1. VRI Phase 2.
8.	Succession effects on Caribou Habitat VRI based ecosystem mapping plus structural stage succession processes analyses as basis for setting management objectives for Caribou habitat.	Needed	Supportive	VRI Phase 1. VRI Phase 2. Plot type T – TEP plus succession.

APPENDIX IV – APPROVAL/SIGNING

I have read and concur with the Vanderhoof Forest District VRI Strategic Inventory Plan, dated XXXX, 1999. It is understood that this is an agreement-in-principle and does not commit the signatories to completing the inventory activities outlined within the plan. Modifications to this plan or more detailed plans need to be reviewed and approved by the signatories.

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District Manager
Vanderhoof Forest District

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Regional Manager
Prince George Forest Region

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Director
Ministry of Environment, Lands and Parks, Resources Inventory Branch

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Director
Ministry of Forests, Resources Inventory Branch

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